

B A S T E R I A

TIJDSCHRIFT VAN DE NEDERLANDSE
MALACOLOGISCHE VERENIGING

VOL. 24, NO. 1 EN 2, PAG. 1—28

25 - V - 1960

Two sibling species of *Pseudamnicola* in Ohrid Lake

by

P. RADOMAN (Beograd)

POLINSKI (1929, 1932) described the endemic species *Pseudamnicola sturanyi* in Ohrid lake (Yugoslavia) and stated that it ranges from a depth of 0 to 30 metres. Biometrical analysis of some populations from the lake at a depth of 0 to 20 metres shows that in POLINSKI's description two groups of populations were included.

In this paper investigations of nine populations are considered. They are: three (1, 2 and 3, fig. 1) from the *Chara* zone which covers the lake at a depth of between 2-3 and 20-25 metres (localities from which these samples were taken are marked with a \oplus ; one (4) from the Zagorican spring; two (5 and 6) from two springs near Sv. Naum; two (7 and 9) from the lake bank (0-0.5 metre deep); and one (8) from a "white" within the *Chara* at a depth of three metres (a "white" is a space covered with gravel but no *Chara*) (localities of samples 4-9 are marked with a $+$). The form from *Chara* generally inhabits the whole zone of this plant, while the second form, besides living in the three springs mentioned near the south border of the lake, is also distributed close to the bank of the lake, on stones and rocks. All samples were collected within a period of two days (July 1958, except the sample from Zagorican, which was collected in July 1955). Each of them was collected from a very small area (about 4 square metres or less).

Only adult specimens were taken into consideration. The measurements of shells were made by means of an ocularmicrometre. The figures thus obtained are given (the size of the *Chara* form is as follows: height of shell 2.3-2.9 mm, width 1.4-2 mm). The height, width, and proportions (width by height) of the shells have been investigated.

BIOMETRICAL ANALYSIS

The statistical data given in table I show that in the characters investigated the major part of the populations differ from one another in their mean values. Some populations show statistically significant differences in the two characters, and only between the populations 1 and 3, and 2 and 3 are there no significant differences in any of the characters investigated here. Only those differences have been considered as significant which are more than three times the corresponding standard error.

Statistical data show very clearly a grouping of populations into two distinct groups, the first of which includes populations from *Chara* (1, 2 and 3) and the second those from the springs and lake bank (4, 5, 6, 7, 8, and 9). The grouping of populations is manifest in regard to shell height and especially shell width. As can be seen from table I, the means of the two characters mentioned are considerably higher in the group of populations from *Chara* than in that from the springs and lake bank. The difference between the *Chara* population with the shortest shells (no. 2) and the spring population with the highest shells (no. 4) is 5.32 ± 1.02 , being 5.22 times as great as its standard error. Similarly the difference of shell width (between populations 2 and 5) is 8.02 ± 0.48 , i.e. 16.71 times as great as its standard error.

The difference between the two groups of populations here investigated can also be seen on comparing the group values of means (total) of shell height and shell width (table I). For shell height that difference (80.61-64.28) is 16.33 ± 0.49 , which is 33.33 times the corresponding standard error, and for shell width it is 10.80 ± 0.26 , i.e. 41.54 times the corresponding standard error. The difference between the total means of shell proportions, which is also statistically significant, is not characteristic here.

The comparison of sets of observations of all populations shows a considerable overlapping of the groups in question in regard to shell height. Regarding shell width, however, the differentiation of the two groups is much clearer, i.e. their overlapping is much less: it includes only 22.43 % of the specimens from the first group and 14 % of the specimens from the second. Those relations are given in table II.

The above data permit one to assign subspecific rank to each of the groups mentioned. However, the following facts allow them to be considered as different species:

1. By means of detailed anatomical comparison a very small but constant anatomical difference in the shape of the penis has been discovered;

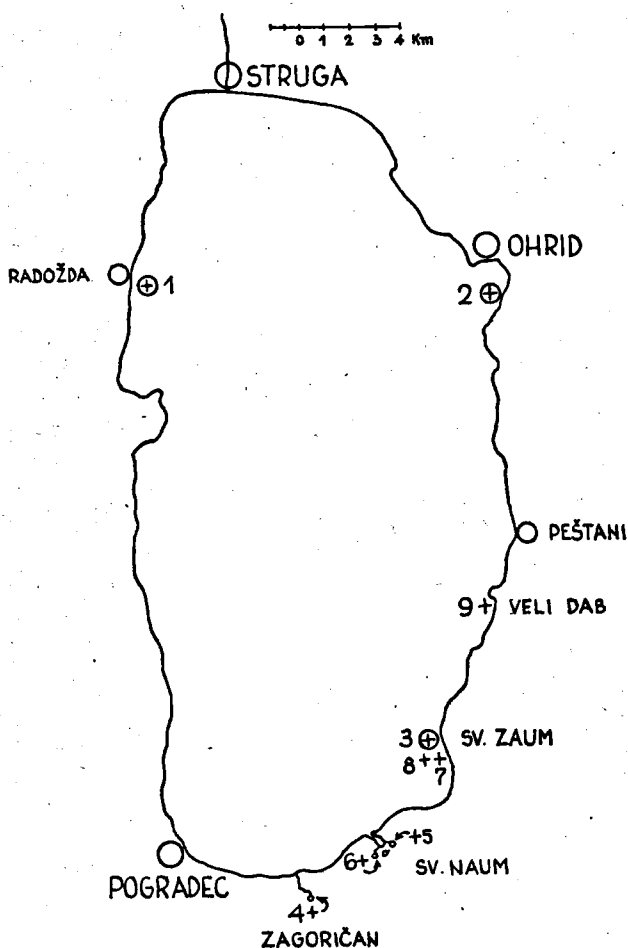


Fig. 1. Map of Ohrid lake with localities where samples were collected.

2. There is a constant difference in body pigmentation: the *Chara* group has sparse black pigmentation, limited mainly to the head and neck and the end of the body, while the spring group has more intense pigmentation of the whole body (including the mantle, which in the *Chara* group is always lacking in pigmentation);

Table I

shell height					shell width				proportions				
N	M	mM	δ	V	M	mM	δ	V	M	mM	δ	V	
Chara populations													
1	75	83.03	± 0.70	6.02	7.25	52.56	± 0.34	2.92	5.56	63.38	± 0.30	2.56	4.04
2	75	78.38	$\pm .78$	6.73	8.59	50.89	$\pm .42$	3.62	6.14	64.79	$\pm .30$	2.56	3.94
3	64	80.38	$\pm .76$	6.10	7.28	51.91	$\pm .40$	3.22	6.20	64.49	$\pm .26$	2.09	3.24
214	80.61	± 0.43	6.29	7.73	51.78	± 0.23	3.26	5.96	64.21	± 0.17	2.42	3.77	
Spring-lake populations													
4	70	73.06	± 0.66	5.56	7.61	41.20	$\pm .28$	2.35	5.70	56.83	$\pm .26$	2.16	3.79
5	69	66.10	$\pm .47$	4.10	6.20	42.87	$\pm .24$	1.98	4.61	65.95	$\pm .34$	2.86	4.34
6	75	66.53	$\pm .51$	4.44	6.68	40.95	$\pm .28$	2.39	5.84	61.43	$\pm .26$	2.21	3.60
7	75	55.94	$\pm .54$	4.64	8.30	36.77	$\pm .27$	2.31	6.29	66.88	$\pm .31$	2.66	3.98
8	45	61.35	$\pm .70$	4.72	7.70	39.40	$\pm .41$	2.77	7.03	64.32	$\pm .41$	2.72	4.23
9	73	63.56	$\pm .68$	5.84	9.19	40.30	$\pm .35$	2.96	7.34	63.58	$\pm .40$	2.64	4.15
407	64.28	± 0.24	4.87	7.64	40.98	± 0.12	2.44	6.12	63.12	± 0.13	2.53	4.00	

N = number
 M = mean
 mM = standard error of the mean
 δ = standard deviation
 V = coefficient of variation

3. The next fact is of special interest: sample no. 8 was collected from a "white" in the *Chara*, but this sample is clearly different in size as in the morphological characters mentioned from sample no. 3, which was collected from *Chara* very close to location no. 8, which is surrounded by *Chara* extending to 2-3 square meters. Neither here nor anywhere else could I find an intermediate form between the two groups of populations.

VARIABILITY

The difference between these two groups of populations is also noticeable in their interpopulation variability (from population to population). For example, the means of shell height in the first group vary between 78.38 and 83.03, that is within a range of 4.65, or 5.77 % of the total mean value of all three populations (80.61). In the second group the interpopulation variability for this character is much higher, being 26.63. In the following table are given the comparative results of interpopulation variability for (a) mean values and (b) their coefficients of variation:

Variability of mean values

	shell height		shell width		proportions	
	range	% of M	range	% of M	range	% of M
<i>Chara</i> group	4.65	5.77	1.67	3.23	1.41	2.20
Spring-lake group	17.12	26.63	6.10	14.89	10.05	15.92

Variability of coefficients of variation

<i>Chara</i> group	1.71	1.61	0.91
Spring-lake group	3.72	2.12	2.41

From the above data one can see that the group of populations from *Chara* is more homogeneous than the second one. That is probably due to much greater variability in the ecological conditions of the spring and lake habitats, where populations of the second group live.

CONCLUSIONS

1. Biometrical analysis of populations from the area which POLINSKI (1929, 1932) designated as the range of the Ohrid endemic species *Pseudamnicola sturanyi* shows that in that area in fact two different groups of populations live: one inhabits the meadows of *Chara*, which grow mainly at a depth of between 2-25 metres, while the second lives in three springs (two in Sv. Naum and one in Zagorican, near the south border of Ohrid lake) and in the lake, close to the lake bank, on stones and rocks.

2. The two groups are conchologically and anatomically very similar to one another. The only observed differences between them are the following:

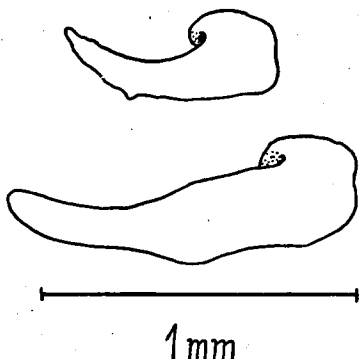


Fig. 2. Penis of *Pseudamnicola polinskii* n.sp. (upper) and *Ps. sturanyi* Polinski (lower).

a. The *Chara* group has a higher shell and a sparse body pigmentation (never any pigment on the mantle); the spring-lake group has a smaller shell and more intense pigmentation of the whole body.

b. The second group has a very small, hardly noticeable outgrowth at the left side of the penis (fig. 2);

3. The fact that the "whites" in the meadows of *Chara* at a depth of 2-3 metres are inhabited by members of the second group indicates a lack of transitional forms between these two groups and their reproductive isolation from one another.

4. All the above facts indicate separation of these groups as sibling species:

a. *Pseudamnicola sturanyi* Polinski, 1929, which mainly lives in *Chara* (fig. 3, upper row).

b. *Pseudamnicola polinskii* n.sp., which inhabits the three springs and the lake bank (fig. 3, lower row).

Diagnosis of the new species: Shell cone-shaped, rather solid. Whorls $4-4\frac{1}{2}$, separated by a rather deep suture and provided with very fine transversal striations. Umbilicus closed, very rarely fissured.

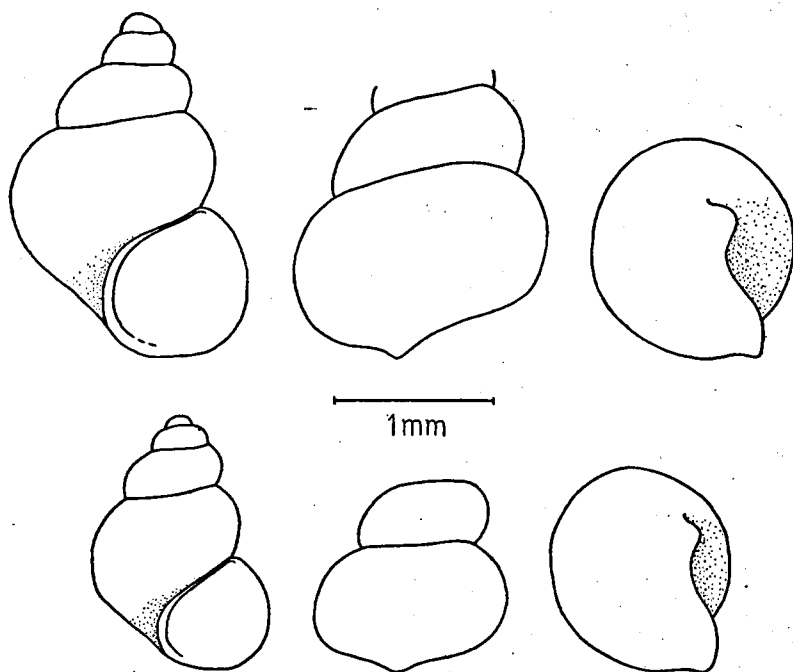


Fig. 3. *Pseudamnicola sturanyi* Polinski (upper row) and *Ps. polinskii* n.sp. (lower row).

Colour of shell whitish, but owing to its transparency and to the black pigmentation of the animal body, shell colour presents a blackish-gray tint.

Aperture nearly egg-shaped. Peristome continuous, leaned against the last whorl, in columella zone a little larger; lower edge of the aperture slightly incised.

Dimensions: Height 1.1-1.9 mm

Width 0.8-1.3 mm

5. One may suppose that the divergence of these species is a result of the difference in ecological conditions (i.e. in "selection pressure") existing in their microgeographically isolated habitats, that is in the lake (especially in the *Chara* zone) and in the springs. These populations, most probably, inhabited the springs in those remote times when the lake extended over them. Regarding the lake bank populations of *Pseudamnicola polinskii*, it may be supposed that they have immigrated into the lake secondarily from the springs.

REFERENCES

- POLINSKI, V., 1929. Reliktna fauna gastropoda Ohridskog jezera: Glas srpske Akad., vol. 137.
POLINSKI, V., 1932. Die reliktnäre Gastropodenfauna des Ohridsees: Zool. Jb., Syst., vol. 62, part 5/6.
RADOMAN, P., 1955. Recherches morphologiques et systématiques sur les Hydrobiides du lac d'Ohrid: Srpsko biolosko drustvo, posebno izdanje (in this paper an anatomical treatment of Ohrid *Pseudamnicolae* is given).

SAMENVATTING

In dit artikel worden biometrische en anatomische analyses gegeven van negen populaties van *Pseudamnicola sturanyi* Polinski uit het Ohrid-meer in Joegoslavië.

Deze analyses hebben aangetoond, dat er twee groepen te onderscheiden zijn:

1. De groep, voorkomend in de *Chara*-zone (stations 1-3), in hoofdzaak levend tussen 2 en 25 m. diepte. Deze dieren hebben een hoog-conische schelp en een spaarzame pigmentatie op het lichaam.
2. De groep, levend in drie bronnen nabij het meer en aan de meeroever (stations 4-9). Deze dieren hebben een kleine schelp en meer intensieve pigmentatie van het lichaam. Bovendien bezitten zij een klein aanhangsel aan de penis.

Hoewel de twee groepen conchologisch en anatomisch zeer veel op elkaar lijken, komen er toch geen overgangsvormen voor. Dit was dan ook de aanleiding om twee "sibling" soorten te onderscheiden: *Pseudamnicola sturanyi* Polinski, 1929 en *P. polinskii* n.sp.